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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/566,473	01/31/2006	Naoki Sugiura	285396US0PCT	5684

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OBLON, SPIVAK, MCCLELLAND MAIER & NEUSTADT, P.C.
1940 DUKE STREET
ALEXANDRIA, VA 22314

EXAMINER

SYKES, ALTREV C

ART UNIT	PAPER NUMBER
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1794

NOTIFICATION DATE	DELIVERY MODE
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04/02/2009

ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

patentdocket@oblon.com
oblonpat@oblon.com
jgardner@oblon.com

Office Action Summary	Application No. 10/566,473	Applicant(s) SUGIURA ET AL.	
	Examiner ALTREV C. SYKES	Art Unit 1794	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 05 March 2009.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-28 is/are pending in the application.
- 4a) Of the above claim(s) 12-15 and 25-28 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-11 and 16-24 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>20060131</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

1. Applicant's election with traverse of Group I claims 1-11 and 16-24 in the reply filed on March 5, 2009 is acknowledged. Claims 12-15 and 25-28 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected invention, there being no allowable generic or linking claim.

The traversal is on the ground(s) that applicant believes that examiner has not satisfied the burden necessary to restrict.

This is not found persuasive because as set forth in the last mailed office action and as acknowledged by applicant in the remarks filed, examiner has clearly shown that no special technical feature exists in the claims. Therefore there is no contribution over the art based on the definition of a special technical feature. Where a group of inventions is claimed in a national stage application, the requirement of unity of invention shall be fulfilled *only* when there is a technical relationship among those inventions involving one or more of the same or corresponding special technical features. (*emphasis added*)

Therefore, examiner has satisfied the burden requiring restriction. Examiner also notes that it is of no moment how applicant classifies the different categories of invention.

Moreover, the placement of the claims in different categories of invention confirms the examiner's position of a burdensome search.

The requirement is still deemed proper and is therefore made FINAL.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1, 2, and 10 are rejected under 35 U.S.C. 102(b) as being anticipated by Hirai et al. (US 5,227,238).

Regarding claims 1 and 10, Hirai et al. discloses carbon fiber chopped strands are bundled by a sizing agent in an amount of from 1 to 10% by weight. (See Col 3, lines 11-15) The sizing agent may be a thermoplastic resin, a thermosetting resin or a mixture thereof at any proportion including epoxy resins, polyester resins, and modified forms of such resins. (See Col 4, lines 7-21) As such examiner equates the resins as described by Hirai et al. to be equivalent to a polymer having a main chain formed of carbon-carbon bonds and containing at least either of an epoxy group and an ester group in at least part of side chains or at least a part of main chain ends.

Regarding claim 2, Hirai et al. discloses all of the claim limitations as set forth above. Hirai et al. discloses when the sizing agent is applied two or more times to the strand, either the same kind or different kinds of sizing agents can be applied. (See Col 6, lines 32-34) Therefore, examiner notes that Hirai et al. anticipates pre-sizing of the carbon fiber bundle with an epoxy resin.

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Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

6. Claims 3-6, 9, 20, 22, 17, and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirai et al. as applied to claim 1 above, in view of Hasegawa et al. (JP 06-107442).

Regarding claim 3, 6 and 17, Hirai et al. discloses all of the claim limitations as set forth above. Hirai et al. further discloses that the sizing agent may be a polyolefin grafted with acrylic acid or maleic acid. (See Col 4, lines 17-21) However, the reference does not specifically disclose at least 35% of an acid modified polypropylene resin having a weight average molecular weight of 45,000 or less and an acid value of 23 to 120 mgKOH/g.

Hasegawa et al. discloses a sizing agent of an acid modified polypropylene resin to be applied to inorganic fibers. (See [0004]) Hasegawa et al. discloses the number

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average molecular weight of the polypropylene system resin was 500-20,000. (See [0007]) Hasegawa et al. discloses maleic acid may be used to modify the polypropylene resin. (See [0011]) Hasegawa et al. discloses the emulsion is usually 5 to 60% of the weight by pitch concentration. (See [0020]) Therefore, the limitation of at least 35 wt% of a sizing agent as claimed is met. Hasegawa et al. further discloses carbon fiber may be chosen as the inorganic fiber. (See [0022]) Hasegawa et al. discloses the coating weight of a sizing agent is usually between 0.5 to 10%. (See [0023])

As Hirai et al. and Hasegawa et al. are both directed to sizing agents for carbon fibers, the art is analogous. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention motivated by expected success to utilize the acid modified polypropylene resin as taught by Hasegawa et al. as the chosen acid modified polyolefin resin as disclosed by Hirai et al. in order to provide the completely expected result of a sized carbon fiber since Hasegawa et al. showed success. Examiner notes that one skilled in the art would have recognized polypropylene as a readily known polyolefin.

Hirai et al. and Hasegawa et al. discloses all of the claim limitations as set forth above, but the references do not teach an acid value of 23 to 120 mgKOH/g or 40 to 75 mgKOH/g. However, examiner has reason to believe that the acid modified polypropylene resin as taught by Hasegawa et al. would have been easily modifiable to provide an acid value of 23 to 120 mgKOH/g. Support for this conclusion is based on the knowledge of one of ordinary skill in the art to recognize that the acid value is the measure of the amount of carboxylic acid groups in a chemical compound. Further,

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Hasegawa et al. discloses that the acid for modifying the polypropylene resin includes unsaturated dicarboxylic acid, fumaric acid, mesaconic acid, and itaconic acid as well as maleic anhydride, anhydrous citraconic acid and mixtures thereof. (See [0011])

Therefore, examiner notes that one of ordinary skill in the art would have been easily motivated by the teaching to provide a sizing agent having an acid value as claimed by applicant.

Regarding claims 4, 5, 18, Hirai et al. discloses urethane-modified epoxy resins, and epoxy-modified urethane resins may be used in any proportion. (See Col 4, lines 7-21) Examiner equates the said modified resins to the olefin-based thermoplastic elastomer resin as claimed by applicant. Hasegawa et al. disclose other sizing agents may be used together with the acid modified polypropylene resin such as a urethane resin emulsion, an acrylic resin emulsion, and an epoxy resin emulsion. (See [0021])

Hirai et al. and Hasegawa et al. both fail to teach at least 5 wt% is used. It would have been obvious to one of ordinary skill in the art at the time the invention was made to optimize the resin amount since it has been held that, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955). The burden is upon the Applicant to demonstrate that the claimed resin amount is critical and has unexpected results. In the present invention, one would have been motivated to optimize the resin amount motivated by the desire to tailor the properties of the final carbon fiber bundle. Hirai et al. discloses the chopped strands have both a high bundling degree and high dispersibility. (See Col 3, lines 40-43) Hasegawa

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et al. discloses a sizing agent which would enhance the compatibility with the fiber reinforced resin. (See [0030])

As such, examiner has reason to believe that the modified resins of Hirai et al. (i.e. urethane-modified epoxy resin) would provide the claimed Vicat softening point as claimed by applicant, there being no showing of record to prove otherwise.

Regarding claim 9 and 22, Hasegawa et al. discloses the use of a silane coupling agent such as aminosilanes, epoxysilane, and arylsilanes. (See [0021])

Regarding claim 20, Hasegawa et al. discloses that the acid for modifying the polypropylene resin includes unsaturated dicarboxylic acid, fumaric acid, mesaconic acid, and itaconic acid as well as maleic anhydride, itaconic acid anhydride, anhydrous citraconic acid and mixtures thereof. (See [0011]) Hasegawa et al. disclose other sizing agents may be used together with the acid modified polypropylene resin such as a urethane resin emulsion, an acrylic resin emulsion, and an epoxy resin emulsion. (See [0021]) Hasegawa et al. also discloses that the emulsions may be used together. (See [0021]) Therefore, examiner has reason to believe that a compound as claimed by applicant to contain propylene, acrylic ester, and an acid anhydride group would have been well within the ordinary skill of one in the art in view of the Hirai et al. and Hasegawa et al. disclosures since the use of more than one resin, whether thermoplastic or thermosetting, modified or not are contemplated by the prior art.

7. Claims 7, 19, 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirai et al. as applied to claim 1 above, in view of Hasegawa et al. (JP 06-107442), and further in view of Rieux et al. (US 3,806,489)

Regarding claims 7 and 19, while Hirai et al. and Hasegawa et al. both disclose the use of more than one resin in the sizing agent, the combined references do not specifically teach a sizing agent comprising at least 40 wt% of a copolymer obtained by copolymerizing ethylene or propylene and an epoxy-containing monomer.

Rieux et al. discloses carbon fiber which have been sized with epoxy resins of the elastomer type. The sizing agent improves the properties of the composite by functioning as a tension damper between the matrix and the reinforcement. (See Col 2, lines 53-62) Rieux et al. discloses typical examples of the elastomer type epoxy resins are epoxy compounds resulting from the condensation of dicarboxylic polyesters with polyglycidic derivatives of phenol or alcohol. (See Col 5, lines 8-16) The dicarboxylic polyester reactant can be formed by reacting a dicarboxylic acid (i.e. fumaric or maleic) with a diol (i.e. ethylene glycol or propylene glycol). The resulting dicarboxylic polyesters are then condensed with a phenol or alcohol such as the diglycidic derivative of bisphenol A. (See Col 5, lines 25-36) Rieux et al. discloses that such epoxy resin provide exceptionally good results since they are very compatible with matrix components thereby providing improved mechanical properties. (See Col 5, lines 44-50)

As Hirai et al., Hasegawa et al. and Rieux et al. are all directed to sizing agents for carbon fibers, the art is analogous. Examiner again notes that using more than one sizing agent of a thermoplastic or thermosetting resin as well as modified versions of those resins in combination was known in the art at the time of the invention. (See Hirai Col 4, lines 4-21) Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention motivated by expected success to modify the type of epoxy

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resins utilized in the sizing agent in order to tailor final carbon fiber bundle properties since Rieux et al. discloses that such epoxy resin provide exceptionally good results since they are very compatible with matrix components thereby providing improved mechanical properties. (See Col 5, lines 44-50) Additionally, it would have been obvious to one of ordinary skill in the art to optimize the weight percent since it has been held that where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Regarding claim 23, Hirai et al. discloses carbon fiber chopped strands are bundled by a sizing agent in an amount of from 1 to 10% by weight. (See Col 3, lines 11-15)

8. Claims 11 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirai et al. as applied to claim 1 above, in view of Hasegawa et al. (JP 06-107442), and further in view of Rieux et al. (US 3,806,489)

Regarding claims 11 and 24, modified Hirai et al. discloses all of the claim limitations as set forth above but the reference is silent as to the fiber bundle having a mass per unit length of 0.4 to 15 g/m and a width/thickness of 3 to 10.

Sugiura et al. discloses chopped carbon fiber bundles for use in a fiber-reinforced composite material. (See Abstract) Sugiura et al. also discloses the carbon fiber bundle are 0.8-5g/m and it is preferred that the fiber bundle width/thickness at the time of cutting are 3-10. (See [0010])

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As modified Hirai et al. and Sugiura et al. are both directed to sized carbon fiber bundles, the art is analogous. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention motivated by expected success to utilize the dimensions as taught by Sugiura et al. for the carbon fiber bundle of modified Hirai et al. in order to tailor the bundle for end product use such as fiber reinforced composite materials. (See Abstract)

9. Claims 8, 16, and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirai et al. as applied to claim 1 above, in view of Ikeda et al. (US 6,569,523).

Regarding claims 8 and 16, modified Hirai et al. discloses all of the claim limitations as set forth above, however the combined references do not disclose wherein the single fibers comprise a plurality of wrinkles.

Ikeda discloses the carbon fiber precursor fiber bundle preferably has wrinkles extending in the longitudinal direction of the fiber bundle on the surface of the monofilament. The presence of these wrinkles imparts an excellent compactness to the carbon fiber precursor fiber bundle of the present invention, and at the same time, the resultant carbon fiber bundle displays an excellent resin impregnating ability and tow spreading ability. (See Col 7, lines 20-25) Ikeda further discloses the depth of the aforementioned wrinkle is set according to the center line average height (Ra), maximum height (Ry) and interval (S) of the local peaks. (See Col 7, lines 28-30) Ikeda discloses the center line average height (Ra) of the surface of the monofilament of the carbon fiber precursor fiber bundle is preferably 0.01 to 0.1 μm . (See Col 7, lines 31-34) Ikeda discloses the maximum height (Ry) of the monofilament surface of the carbon fiber

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precursor fiber bundle is preferably 0.1 to 0.5 μm . (See Col 7, lines 53-55) Examiner equates these values to the lowest portions and highest portions of the wrinkles, respectively. Ikeda discloses in addition, the interval (S) between neighboring local peaks which serves as a parameter specifying the interval of these wrinkles is preferably 0.2 to 1.0 μm . (See Col 8, lines 7-10) Examiner notes that Ikeda discloses an average height (R_a) and a maximum height (R_y). Therefore, the difference of the two (i.e. 0.5 μm -0.1 μm), would give a calculated minimal value of $\sim 0.40 \mu\text{m}$. Applicant claims a difference between the highest and lowest portions to be 40nm (i.e. 0.04 μm) or more. While the region is not specifically defined for circumferential length and axial direction length, examiner has reason to believe that one of ordinary skill in the art would have been readily motivated to measure the effect of the wrinkling along the fiber as claimed by applicant. Support for this conclusion is found in Ikeda where a laser microscope is used to determine the difference between neighboring local peaks as well as to measure the maximum heights. (See Figure 2, and Col 8, lines 1-6 and 20-26) Therefore, examiner has reason to believe that the claim limitation is met.

Regarding claim 21, Ikeda discloses the ratio (length/width) of the length and width of the fiber cross section of a monofilament of the acrylonitrile-based polymer according to the present invention is 1.05 to 1.6, preferably 1.1 to 1.3, and more preferably 1.15 to 1.25. (See Col 6, lines 12-19) Ikeda discloses the amount of Si of the carbon fiber precursor fiber bundle is within the range of 500 to 4000 ppm. (See Col 6, lines 47-50) Ikeda discloses the amount of Si can be measured by means of using ICP atomic emission spectrometry. (See Col 7, lines 1-2)

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10. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Conclusion

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to ALTREV C. SYKES whose telephone number is (571)270-3162. The examiner can normally be reached on Monday-Thursday, 8AM-5PM EST, alt Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Sample can be reached on 571-272-1376. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/David R. Sample/
Supervisory Patent Examiner, Art Unit 1794

/ACS/
Examiner
3/26/09